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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/320,271	05/27/1999	HIROYUKI WATANABE	990559	4409

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EXAMINER

LEE, CALVIN

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 04/09/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/320,271

Applicant(s)

WATANABE ET AL.

Examiner

Calvin Lee

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-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 28 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 27 May 1999 is: a) ☒ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## FINAL ACTION

### *Response to Pre Amendment*

1. The amendment of claim 1 in Amendment C, dated 01/28/02, is acknowledged.

### *Claim Rejections - 35 USC § 112*

2. Claims 1-13 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The invention does not disclose or suggest “a trench extending in a line (linearly)”.

### *Claim Rejections - 35 USC § 102*

3. Claims 1-13 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by *Mizuhara et al.* or *Watanabe et al.*

a) *Mizuhara* discloses a semiconductor device and its method, comprising the steps of:

- forming an organic SOG layer **9** as a first insulator, having substantially uniform thickness, on an oxide film **8** and over a flat substrate's face (Figs. 4-5 and col. 4, lines 25-43)
- introducing impurities B<sup>+</sup> into the organic SOG layer (so the impurities arrive at the interface between the SOG layer and its underlying oxide), thereby modifying the organic SOG layer **9** to an SOG layer **10** (Fig. 6 and col. 4, lines 45-51)
- forming a via hole **12** in the modified SOG layer using a mask pattern (col. 4, lines 58-62)
- embedding and forming a first conductive layer **13** of copper alloy in the trench (col. 5)

The method can extend to have second, third, and fourth interconnections, as desired, by repeating the above steps (col. 5 line 61 through col. 6 line 62).

b) *Watanabe* teaches a fabrication method of a semiconductor device, comprising the steps:

- forming a first insulating layer **8** of organic SOG, containing 1% of carbon, on an oxide film **5** and overlying a substrate **1** (col. 5 line 17 through col. 6 line 30)

- introducing impurities into the insulating layer (Fig. 4) so the impurities arrive at the interface between the insulating layer and the oxide film (col. 6, line 39 and col. 7, line 32)

Note: the implantation at the interface between organic SOG layer **8** and oxide film **5** prevents modified SOG layer **9** (col. 6, line 53) from being easily peeled off from the oxide film (col. 6, lines 52-59 and col. 7, lines 30-37)

- forming a via hole **10** in the insulation layer (col. 8 lines 52-63)

- embedding and forming a first conductive layer **11** over the trench (Fig. 5 and col. 7 lines 9-29)

The method can be repeated to form a conventional multi layer structure having second, third, and fourth interconnections, as required.

Although neither *Mizuhara et al.* nor *Watanabe et al.* teaches or suggests a trench, their via holes are equivalent to a claimed trench for subsequent interconnect formation. As a result, both *Mizuhara et al.* and *Watanabe et al.* inherently teaches a trench formed in an insulating layer

#### ***Response to Arguments***

4. Applicant's argument that *Mizuhara et al.* or *Watanabe et al.* fails to teach a trench is unpersuasive. The via holes **12** and **10** of *Mizuhara et al.* and *Watanabe et al.*, respectively can be called trenches, recesses or openings, which is a matter of name choice because these features are nothing more than an etched opening for subsequent interconnect formation.

Therefore, Applicants' argument is moot in light of the new rejection.

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**Contact Information**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Calvin Lee whose telephone number is 703-306-5854. The examiner can normally be reached on Monday-Friday 6:30- 5:00.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on 703-308-1323. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3431 for regular communications and 703-305-3431 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0596.

Calvin Lee  
Examiner  
Art Unit 2825

\*\*\*MSS

April 8, 2002

  
MATTHEW S. SMITH  
SUPERVISOR  
TECHNOLOGY CENTER 2030